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January 28, 2019

By ECFS

Marlene Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: **Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations, WT Docket No. 18-197**

Dear Ms. Dortch:

In this letter, DISH Network Corporation (“DISH”) responds to the Applicants’ December 14, 2018 ex parte providing additional information about how their economists estimated the extent to which customers switch between Sprint and T-Mobile, known as “diversion.”¹ The Applicants’ economic experts have admitted that the merger will produce substantial price increases. Indeed, under the Applicants’ own calculations, these price increases are not offset by even wildly over-inflated marginal cost savings, nor are they counter-balanced by an assumed and unproven willingness of customers to pay more for equally assumed and unproven quality improvements.

¹ Mark Israel, Michael Katz, and Bryan Keating, *Additional Information Regarding the Estimation of Diversion Ratios at 1*, attached to letter from Nancy Victory, T-Mobile, to Marlene Dortch, FCC, WT Docket No. 18-197 (Dec. 14, 2018) (“T-Mobile Diversion Ex Parte”).

DISH has denoted with **{{BEGIN HCI END HCI}}** information that is deemed to be Highly Confidential Information pursuant to the *Protective Order* and denoted with **{{BEGIN NRUF/LNP HCI END NRUF/LNP HCI}}** information that is deemed to be Highly Confidential Information pursuant to the *NRUF/LNP Protective Order*. A public, redacted version of this filing is being filed with the Commission. Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations, *Protective Order*, WT Docket No. 18-197, DA 18-624 (June 15, 2018); Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations, *NRUF/LNP Protective Order*, WT Docket No. 18-197, DA 18-777 (July 26, 2018).

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But, even the Applicants’ dismal showing is based on unduly optimistic assumptions about diversion between the two carriers. They assume that too few people leave Sprint for T-Mobile (and vice-versa), and hence that less competition will be lost because of the merger than would be the case if more accurate diversion information is considered.² In that respect, the Applicants have disregarded the local number portability data (information on customers porting their number from one carrier to the other, called “porting data”), which show plainly that each of the Applicants is the other’s fiercest competitor: a full **{{BEGIN NRUF/LNP HCI
END NRUF/LNP HCI}}** of customers leaving Sprint go to T-Mobile, and **{{BEGIN
NRUF/LNP HCI END NRUF/LNP HCI}}** of those who leave T-Mobile go to Sprint.³ Instead, the Applicants’ two sets of experts point to, variously, a study commissioned by Sprint, the Harris survey,⁴ and a method propounded by Cornerstone to claim that switches from one Applicant to the other are much lower than shown by the actual porting data.⁵ The Applicants’ December 18 letter defends their use of these alternative methods. Critically, the Applicants are not disputing that the transaction will produce price increases, but rather disagreeing about how large they will be. Under the Applicants’ own methods of calculating diversion, price increases before any marginal cost savings would be on the order of **{{BEGIN HCI
END HCI}}**⁶ Use of porting

² Diversion measures the degree to which customers would substitute a competitor’s products in response to a price increase. See Carl Shapiro, *Mergers with Differentiated Products*, Antitrust, at 23 (Spring 1996) (“The concept underlying the Diversion Ratio is easily comprehensible: “If you raise your price, what fraction of your lost customers will turn to your rival (now merger partner).”). The extent to which two merging firms are direct competitors to each other “is central to the evaluation of unilateral price effects.” U.S. Department of Justice and Federal Trade Commission, Horizontal Merger Guidelines § 6.1 (2010) (explaining that “unilateral price effects are greater, the more the buyers of products sold by one merging firm consider products sold by the other merging firm to be their next choice.”).

³ See Declaration of Compass Lexecon, Table 28 (Sept. 17, 2018) (Appendix F to Joint Opposition of T-Mobile US, Inc. and Sprint Corporation, WT Docket No. 18-197 (Sept. 17, 2018) (“Compass Lexecon Declaration”).

⁴ See Compass Lexecon Declaration ¶ 178.

⁵ See John Asker, Timothy F. Bresnahan, and Kostis Hatzitaskos, *Economic Analysis of the Proposed Sprint/T-Mobile Merger* ¶ 74 (Nov. 6, 2018), (Attachment A to letter from Nancy Victory, Counsel for T-Mobile, to Marlene Dortch, FCC, WT Docket No. 18-197 (Nov. 6, 2018)) (“Cornerstone Report”).

⁶ Reply Declaration of Joseph Harrington, Coleman Bazelon, Jeremy Verlinda, and William Zarakas, at 13, Table 1; (Exhibit 1 to Reply of Dish Network Corp., WT Docket No. 18-197 (Oct. 31, 2018) (“Brattle Compass Lexecon Reply”); Further Reply Declaration of Coleman Bazelon, Jeremy Verlinda, and William Zarakas at 23, Table 5, attached to DISH Network Corp. (Continued...)

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data results in dramatically greater increases, of as much as **{{BEGIN HCI
END HCI}}**⁷

The Applicants' criticisms of, and doubts about, porting data are not convincing, nor are they supported by their own internal documents. As Brattle explains, while not perfect, porting data remain the best proxy for customer diversion in response to price changes. And, in contrast to how they discuss data in the context of this merger, the Applicants have agreed about the relevance of porting data when conducting their own business. Indeed, T-Mobile's leadership uses porting data to assess how T-Mobile is doing in comparison with Sprint and believes (correctly) that changes in the porting numbers are attributable to price promotions. Data examined in the ordinary course by the Applicants leave no doubt about the correlation of porting data and price changes. Specifically, when T-Mobile's CEO wrote he was **{{BEGIN HCI
END HCI}}** T-Mobile's Chief

Commercial Officer explained that **{{BEGIN HCI
END HCI}}**⁸ In fact, a T-Mobile document shows that **{{BEGIN HCI
END HCI}}**⁹ And Sprint's Chief

Operating Officer **{{BEGIN HCI
END HCI}}**¹⁰

These are just a few examples of the ordinary course internal documents that demonstrate that both Applicants rely on porting data to estimate customer diversion. This extensive ordinary course documentation contradicts the Applicants' submissions to the Commission, and recent interviews (conducted in December 2018) with executives from the Applicants to support the idea that they do not consider porting data to be reliable. These interviews' recent vintage, and the inconsistency between their supposed conclusions and some of the documents, suggests that they are informed by the Applicants' advocacy needs. In addition, it is not clear what these conclusions are drawn *from*, as the Applicants have not produced the interview transcripts, which they should be required to do.

Comments in Response to Public Notice Regarding Cornerstone Report, WT Docket No. 18-197 (Dec. 4, 2018).

⁷ Brattle Compass Lexecon Reply at 16, Table 2.

⁸ See TMUS-FCC-02376783 **{{BEGIN HCI
END HCI}}**

⁹ See TMUS-FCC-01648593 at TMUS-FCC-01648600 **{{BEGIN HCI**

HCI}} **END HCI}}** See
also SPR-FCC-04362565 **{{BEGIN HCI
HCI}}**

¹⁰ SPR-FCC-00910278, **{{BEGIN HCI
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The Applicants' economic experts Compass Lexecon are undoubtedly aware that the Applicants' internal documents do not support the idea that the Harris survey data are more accurate proxies of diversion than LNP porting data. It is apparently for that reason that Compass Lexecon seeks to sidestep the debate by invoking Cornerstone's use of Nielson Mobile Performance ("NMP") data. According to Compass Lexecon, Cornerstone's analysis "directly calculate[s] true diversion ratios."¹¹ But, as Brattle demonstrates, the Cornerstone analysis does nothing of the kind.¹² Instead, Cornerstone's model is simply designed to estimate diversion that tracks almost precisely the carriers' market shares. It is this flaw of the Cornerstone model that explains a fundamental contradiction in Cornerstone's report. Cornerstone claims that Sprint and T-Mobile are closer in quality to each other than to either of AT&T and Verizon. Why then does Cornerstone's method show that **{{BEGIN HCI**

END

HCI}} The explanation is simply Verizon's larger market share.

The extent to which Cornerstone misestimates diversions for that reason is significant. For example, the Sprint surveys cited by Compass Lexecon show that **{{BEGIN HCI** **END HCI}}** of subscribers porting out of Sprint's Boost prepaid service switch to Metro PCS with just **{{BEGIN HCI** **END HCI}}** switching to either AT&T or Verizon.¹³ Even the Harris survey shows that more than **{{BEGIN HCI** **END HCI}}** of subscribers leaving Boost switch to Metro PCS, with just **{{BEGIN HCI** **END HCI}}** switching to either AT&T or Verizon.¹⁴ In stark contrast, the Cornerstone model calculates the Boost-to-Metro PCS diversion ratio as just **{{BEGIN HCI** **END HCI}}** with over **{{BEGIN HCI** **END HCI}}** switching to either AT&T or Verizon postpaid products combined.¹⁵ This is in line with AT&T's and Verizon's market shares, but out of sync with any reasonable expectation about the behavior of prepaid customers.

Finally, even the Harris survey shows that diversions between the two Applicants are sharply higher for relevant subscribers, especially in urban areas, when the data are geographically disaggregated than the aggregate number used by Compass Lexecon.

¹¹ T-Mobile Diversion Ex Parte at 1.

¹² See Coleman Bazelon, Jeremy Verlinda, and William Zarakas, Response to Applicant Filings on Diversion Ratios at 23 (Jan. 28, 2019), attached as Appendix A.

¹³ SPR-FCC-02425213 at SPR-FCC-02425217, **{{BEGIN HCI**
END HCI}}

¹⁴ Appendix A at 28-29.

¹⁵ See Cornerstone Report ¶ 76 Exhibit 12.

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I. The Applicants’ Own Evidence Demonstrates the Superiority of Porting Data in Predicting Consumer Behavior

Compass Lexecon acknowledges that T-Mobile used porting data internally because it is “available on a nearly contemporary basis (as compared to information gleaned from public company reports or through commissioned surveys).”¹⁶ But Compass Lexecon attempts to negate these ordinary-course materials with recent interviews conducted with T-Mobile executives in December 2018.¹⁷ These post-hoc and self-serving interviews, with no transcripts provided, cannot be given the same weight as pre-merger materials used in the ordinary course of business. DISH requests that the Commission direct the Applicants to submit the full transcripts of the cited interviews into the record of this proceeding, rather than relying on summaries of cherry-picked portions.

More troubling, Compass Lexecon mischaracterizes the Applicants’ internal use of porting data. Compass Lexecon states that “[t]he parties have concluded in the ordinary course that porting data are unreliable.”¹⁸ This is not the case, especially outside of the prepaid segment. Compass Lexecon cites to only three T-Mobile documents for this proposition,¹⁹ ignoring the substantial volume of internal materials which use porting data. The first document, TMUS-FCC-04252052, is an e-mail exchange noting that porting **{{BEGIN HCI**

END HCI}} This is true, but does not imply any kind of systematic bias for purposes of using porting data as an estimate for diversion. The second document, TMUS-FCC-01914010, simply states the truism that porting, like any data source, becomes less useful the smaller the sample size. Remarkably, the third document, TMUS-FCC-01909049, includes a strongly favorable assessment of the virtues of porting that Compass Lexecon left out of the quote. The document includes **{{BEGIN HCI**

END HCI}}²⁰

In fact, the Applicants’ own documents prove that customer port-in and port-out numbers correlate closely to price changes. The following chart, contained in a T-Mobile document, charts **{{BEGIN HCI**

END HCI}}:

¹⁶ T-Mobile Diversion Ex Parte at 6 n. 24.

¹⁷ *See id.* at 5 n. 23-24.

¹⁸ *Id.* at 5.

¹⁹ *See id.* at 6 n. 24-26.

²⁰ TMUS-FCC-01909049 at TMUS-FCC-01909051 **{{BEGIN HCI**
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{{BEGIN HCI

END HCI}}²¹

This document is doubly probative, both in showing the close alignment between price changes and net port changes, and in showing T-Mobile's awareness of it. What is more, the same analysis was conducted for prepaid services, showing a similar extent of alignment between prepaid service net port changes and price changes and, again, T-Mobile's keen awareness of that relationship. This document thus directly belies Cornerstone's insistence that such an analysis is impossible.²²

²¹ TMUS-FCC-01648593 at TMUS-FCC-01648600 **{{BEGIN HCI
END HCI}}**

²² See Cornerstone Response to DISH and CWA Comments ¶ 18 (Dec. 18, 2018) (Attachment A to letter from Nancy Victory, Counsel for T-Mobile, to Marlene Dortch, FCC, WT Docket No. 18-197 (Dec. 18, 2018)).

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{{BEGIN HCI

END HCI}}²³

T-Mobile executives at the company's highest levels **{{BEGIN HCI
END HCI}}** In a spirited exchange during the summer of
2016, T-Mobile executives were particularly concerned about **{{BEGIN HCI**

END HCI}}²⁴ Thus, high-level T-Mobile executives not

²³ TMUS-FCC-01648593 at TMUS-FCC-01648615 **{{BEGIN HCI
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²⁴ TMUS-FCC-02376783 **{{BEGIN HCI
END HCI}}** *See also* TMUS-FCC-02338784 **{{BEGIN HCI**

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only used porting data, but put it to a very specific use—**{{BEGIN HCI
END HCI}}**

In a strikingly parallel narrative on the Sprint side, the Softbank CEO and Sprint
Chairman **{{BEGIN HCI**

END HCI}}²⁵

It is therefore no surprise that there are numerous examples in the record of T-Mobile and
Sprint executives using porting data in the ordinary course of business. Despite having access to
Nielsen data, T-Mobile's SVP of Marketing Engineering wrote that **{{BEGIN HCI**

END HCI}}²⁶ Another T-Mobile executive emphasized
that **{{BEGIN HCI**

END HCI}}²⁷ Even for purposes of MVNO metrics, T-
Mobile **{{BEGIN HCI**

END HCI}}²⁸

Notably, T-Mobile does not receive porting data directly from the LNP database, but
instead from a commercial supplier, **{{BEGIN HCI**

HCI}}

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²⁵ SPR-FCC-00771060 at SPR-FCC-00771063, **{{BEGIN HCI
END HCI}}** See also SPR-FCC-00887627 **{{BEGIN HCI**

END HCI}}

²⁶ TMUS-FCC-00211407 at TMUS-FCC-00211409 **{{BEGIN HCI
END HCI}}** See also TMUS-
FCC-00215242 **{{BEGIN HCI**

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²⁷ TMUS-FCC-00211481 **{{BEGIN HCI
END HCI}}**

²⁸ TMUS-FCC-00793401 at 00793402 **{{BEGIN HCI**

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END HCI}}²⁹

Sprint puts porting data to similar uses. **{{BEGIN HCI**

END HCI}}³⁰ Sprint generates a **{{BEGIN HCI**

END HCI}}³¹

Compass Lexecon cites a handful of documents that show T-Mobile using Harris survey data. But, the documents cited by Compass Lexecon show that Harris data are used with a different, more specific focus:**{{BEGIN HCI**

END

HCI}}³² Compass Lexecon also notes that “MetroPCS also conducts its own deactivation survey, which yields even lower switching rates between Sprint and T-Mobile than do the HarrisX data,”³³ but this survey appears to be about switching into and out of *MetroPCS*, not directly between Sprint and T-Mobile.³⁴

²⁹ TMUS-FCC-00916511 **{{BEGIN HCI**
END HCI}} *See also* TMUS-FCC-00211481 **{{BEGIN HCI**

END HCI}}

³⁰ SPR-FCC-00910278 **{{BEGIN HCI**
END HCI}}

³¹ *See, e.g.*, SPR-FCC-00000290. **{{BEGIN HCI**
END HCI}} Additional examples of reports using
porting include **{{BEGIN HCI**

END HCI}}

³² *See e.g.*, TMUS-FCC-00796583 **{{BEGIN HCI**
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³³ T-Mobile Diversion Ex Parte at 6.

³⁴ *See* TMUS-FCC-07675268 **{{BEGIN HCI**
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II. Brattle Shows the Superiority of Porting Data as a Benchmark of Switching Behavior

DISH has previously explained that the Commission has often relied upon porting data as the best measure of diversion. For example, the Commission’s AT&T/T-Mobile Staff Report used porting data.³⁵ And, in the AT&T/Leap proceeding, Mark Israel, one of the Applicants’ current economists, recognized that despite potential limitations, “porting data provide a useful indicator of the degree of substitution between providers.”³⁶ The Commission agreed, using porting data to determine that AT&T and Leap were close substitutes in certain markets.³⁷ Similarly, in the AT&T/ATN transaction, the Commission used porting data to determine whether AT&T and ATN were close substitutes.³⁸

Analysis of the porting data confirms its superiority in predicting price increases here, too. As Brattle explains, movement of customers in the porting data between the Applicants and other wireless carriers closely corresponds to industry benchmarks for switch-ins and churn. Compass Lexecon has argued that porting data are at odds with “gross additions,” “gross deactivations” and survey-based “switch in” and “switch out” data, and should therefore be excluded from consideration when calculating diversion ratios for use in the merger simulation analysis. However, examination of these data tells the opposite story.

Table 1 shows three data sets that Compass Lexecon reviewed in its report.³⁹ Compass Lexecon relied on these tables to claim that porting data must be over-sampling customers who switch to Sprint because the port-ins to Sprint (about **{{BEGIN HCI END HCI}}**) are higher than Sprint’s estimated share of gross-adds, while the share of switch-ins in the Harris data is comparable to the share of gross adds (both about **{{BEGIN HCI END HCI}}**). Compass Lexecon also notes that the share of port-ins to AT&T and Verizon are **{{BEGIN HCI END HCI}}** than the estimated share of gross adds for those carriers, while the Harris data is again (more) comparable to the estimated gross adds.

³⁵ See Reply of DISH Network Corporation, WT Docket No. 18-197, at 15-16 (Oct. 31, 2018).

³⁶ Mark A. Israel, *An Economic Analysis of Competitive Effects and Consumer Benefits from the Proposed Acquisition of Leap Wireless by AT&T* ¶ 27, WT Docket No. 13-193 (Aug. 9, 2013).

³⁷ Cricket License Co. and AT&T Inc., Consent to Transfer Control of Authorizations, *Memorandum Opinion and Order*, 29 FCC Rcd. 2735, 2765 ¶ 70 (2014).

³⁸ See Applications of AT&T Inc. and Atlantic Tele-Network, Inc., *Memorandum Opinion and Order*, 28 FCC Rcd. 13670, 13691 n.121 (2013).

³⁹ See Compass Lexecon Declaration, Table 27.

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Table 1: Share Comparison between Gross Adds, Port-Ins, and Switch-Ins From Various Sources (Most Recent 12 Months of Data)

{{BEGIN NRUF/LNP HCI

END NRUF/LNP HCI}}

Sources: IKK Backup Materials; LNP data; KPMG StreamShare. See IKK Declaration at p. 129, Table 27.

In Table 1, Brattle supplements the information in the Compass Lexecon report to also include gross adds information from the KPMG StreamShare data (which Cornerstone uses as the benchmark data source for subscriber share). Based on KPMG's estimates of gross adds, the opposite conclusions would be reached about which carriers are over- and under-sampled in the porting (and Harris) data. Relative to the KPMG share of gross adds estimates, the porting data undersample switches to Sprint and oversample switches to AT&T, while the Harris data exaggerate these trends even further (AT&T even more oversampled, Sprint even more undersampled). In other words, the porting data are a more conservative indicator of customers switching to Sprint than suggested by KPMG's gross adds.

The same comparison can be made when considering deactivations (i.e., churn) instead of gross adds. This is shown in Table 2. Here, the difference between porting, Harris switching, and the share of deactivations is as large as any difference between either of them and port-outs. Both the porting data and Harris data under-sample Sprint churn relative to KPMG deactivations, and both overstate AT&T churn. For T-Mobile, the porting data more closely approximate deactivations than is seen in the Harris data. And the Harris data oversample Verizon switch-outs while the porting data undersample Verizon's churn. The Harris data *understate* T-Mobile's share of churn (while porting data arguably do not), and the porting data, if anything, oversample AT&T's churn. Thus, consideration of these data would also have led Compass to conclude that porting data present a conservative estimate of overall switching behavior.

Table 2: Share Comparison between Deactivations, Port-Outs, and Switch-Outs From Various Sources (Most Recent 12 Months of Data)
{{BEGIN NRUF/LNP HCI

END NRUF/LNP HCI}}⁴⁰

Sources: IKK Backup Materials for Table 27; LNP data; KMPG StreamShare. See IKK Declaration at p. 129, Table 27.

III. The Cornerstone Method Simply Estimates Diversions Proportional to Market Shares, and Does So by Design

Compass Lexecon originally listed five different methods of estimating diversion.⁴¹ It now attempts to sidestep the discussion entirely by arguing that “the discussion of which switching rates to use as proxies for diversion ratios has largely been rendered moot” by the use of Nielsen Mobile Performance (“NMP”) data.⁴²

But Compass Lexecon misstates the reliability of the NMP data.⁴³ Cornerstone specifically states that it *cannot* directly measure diversion using NMP: “demand models can often be used to directly measure consumer responsiveness to price. *We cannot do this as part of our demand model.*”⁴⁴ Instead, Cornerstone describes its diversion figures using NMP as an “estimate.” But it is not a true estimate: it is no more than a set of assumed values that effectively reproduce diversion in proportion to market share.

⁴⁰ See Appendix A at 10.

⁴¹ See Compass Lexecon Declaration ¶ 178.

⁴² T-Mobile Diversion Ex Parte at 1.

⁴³ *Id.*

⁴⁴ See Cornerstone Report ¶ 74 (“Ideally, we would have data where different consumers faced different prices either across locations or over time. This would allow us to estimate how choices vary with prices. However, in this case each brand sets prices nationally and we lack sufficient intertemporal variation in prices to directly estimate price sensitivity within our demand model.”).

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As explained in DISH’s reply to the Cornerstone Report, Cornerstone’s diversion “estimates” were characterized by a paradox: they were, and are, inconsistent with its conclusion that customers perceive Sprint and T-Mobile as closer in quality to each other than to either AT&T or Verizon.⁴⁵ Yet Cornerstone offers no explanation (either in its original report or its response) for why its diversion estimates instead show **{{BEGIN HCI END HCI}}** as the closest competitor for Sprint and T-Mobile.⁴⁶ The answer is simple: the Cornerstone method does not find share-proportionality, but instead merely assumes it. As Brattle explains, diversion ratios derived from Cornerstone’s “logit” demand model reflect an assumption of share-proportionality, where at the individual subscriber level shares are the estimated subscriber probabilities of choosing a brand. But since the weighted average of subscribers’ choice probabilities in that model will reproduce exactly the brand share in each geographic region, the resulting diversion ratios across all subscribers also effectively collapse into the same share-proportionality assumption. The Cornerstone study assumes that consumers will switch between carriers in proportion to these carriers’ shares. This alignment of supposed diversion “estimates” and pure share proportionality is shown vividly in the following figure.

⁴⁵ See DISH Network Corp. Comments in Response to Public Notice Regarding Cornerstone Report, WT Docket No. 18-197, at 15-17 (Dec. 4, 2018).

⁴⁶ See Cornerstone Report ¶ 76 Exhibit 12.

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**Cornerstone Diversion Estimates versus Share Proportionality
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IV. The Harris Survey Data Show Much Greater Diversions Between the Applicants in Certain Geographic Areas

A close review of Harris survey data, too, shows greater switching between the Applicants in certain markets than revealed by Compass Lexecon based on an aggregate view of the data. Thus, the Harris data themselves show that, in urban areas, **{{BEGIN HCI
END HCI}}** of subscribers leaving Sprint go to T-Mobile. This is close to the **{{BEGIN
NRUF/LNP HCI END NRUF/LNP HCI}}** shown by the porting data for the nation. The following table shows diversions for urban, suburban core, suburban fringe, and rural areas based on the Harris data. As Brattle explains, subscribership for both T-Mobile and Sprint, and in particular their prepaid brands MetroPCS and Boost/Virgin, is greatest in **{{BEGIN HCI
END HCI}}** in noted contrast to AT&T and Verizon subscribership. Brattle

⁴⁷ See Appendix A at 27.

Attachment A

Response to Applicant Filings on Diversion Ratios

Coleman Bazelon

Principal, The Brattle Group

Jeremy Verlinda

Principal, The Brattle Group

and

William Zarakas

Principal, The Brattle Group

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I. Introduction and Summary

We respond to the various filings by the Applicants’ economists as they pertain to estimation of diversion ratios; *i.e.*, the fraction of a brand’s lost sales that divert to another brand, in response to an increase in price (or reduction in quality). In prior merger analyses, the Commission has used local number portability (“LNP,” or porting) data to calculate diversion ratios. The Applicants’ economists (Compass and Cornerstone) however, claim that porting data is irrelevant in assessing customer response and should not be considered in the calculation of diversion ratios.¹

Imperfections notwithstanding, porting data is exceptionally relevant and useful; it is used extensively by both Sprint and T-Mobile in evaluating marketing programs and in making important decisions concerning promotions in the ordinary course of business. Both companies use porting data to track and analyze consumer responses to changes in pricing—making porting data both a highly relevant and important business indicator.

The alternative diversion ratios put forward by Compass² (whom we have previously referred to as “IKK”) and Cornerstone³ either understate the relevant diversion ratios or are based on flawed methodologies or calculations. Both sets of the Applicants’ economists point to the diversion ratios calculated by Cornerstone as the most accurate for purposes of this merger analysis, and assert that these should supersede any prior calculations. However, the claimed attractiveness of Cornerstone’s diversion ratios—namely that they are estimated using an individual-level logit demand model based on detailed Nielsen Mobile Performance (“NMP”) data—is negated because

¹ Additional Information Regarding the Estimation of Diversion Ratios by Mark Israel, Michael Katz, and Bryan Keating. *In the Matter of Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations*, WT Docket No. 18-197, December 14, 2018 (henceforth “IKK Diversion White Paper”).

² Declaration of Compass Lexecon by Mark Israel, Michael Katz, and Bryan Keating. *In the Matter of Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations*, WT Docket No. 18-197, September 17, 2018 (henceforth “IKK Declaration”).

³ Economic Analysis of the Proposed T-Mobile/Sprint Merger by John Asker, Timothy F. Bresnahan, and Kostis Hatzitaskos. *In the Matter of Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations*, WT Docket No. 18-197, November 6, 2018 (henceforth “Cornerstone Report”).

they are predetermined to produce diversion ratios that are nearly identical to those calculated using simple market share data alone. The Cornerstone diversion ratios, therefore, cannot be used in the merger simulation analysis.

Compass has stated that the Cornerstone diversion ratios are superior to its own estimates, based on Harris Mobile Insights survey data, and that, in any event, additional information on diversion, such as from company documents and surveys, would suggest low diversion among the Applicant brands. Yet, the Harris-based diversion values among the Applicants' brands, as reported by Compass, are likely too low. In addition, Sprint and T-Mobile internal documents used in analyzing consumer behavior and planning marketing programs and initiatives also belie the diversion ratios put forward by the Applicants' economists. The Applicants' internal analyses make clear that switching among the various Sprint and T-Mobile brands is higher than claimed by the Applicants' experts.

We make four key findings and conclusions in regards to the estimation of diversion in this merger review:

- Review of internal Sprint and T-Mobile documents indicates that porting data is extensively used to identify who is capturing their subscribers and who they capture them from, to measure performance against rival carriers, and to evaluate the effects of pricing promotions on changes in subscribership relative to individual rival carriers. With porting data playing an important role in carriers' pricing decisions, it is thus a highly relevant and practical indicator of brand substitutability.
- The Applicants also collect survey data in the ordinary course of business, which also indicates that diversion ratios should be much higher than suggested by Compass and Cornerstone. Particularly for the Applicants' prepaid brands, these data indicate **{{BEGIN HCI
END HCI}}**. Compass' representation that the Applicants' internal documents indicate that there is low diversion between Sprint and T-Mobile brands is based on a cherry-picked sample of documents that is at odds with a more detailed review.
- Sprint's and T-Mobile's competitive focuses are more **{{BEGIN HCI
END HCI}}** Using the Harris switching data for urban and suburban customers results in diversion ratios for Sprint to T-Mobile of **{{BEGIN HCI**

END HCI}} and for T-Mobile to Sprint of {{BEGIN HCI
HCI}}. END

- Despite its claim of using a “rich” NMP data set to estimate diversion ratios, the mathematics behind the Cornerstone model reveal conceptual flaws such that the model produces non-credible results. Derivation of the formulas for diversion calculations in the Cornerstone model indicates that:
 - The model’s diversion ratio estimates are driven entirely by assumption, and are only able to reproduce diversion that is effectively in proportion to share.
 - The model’s diversion estimates are entirely unaffected by changes in prices or network quality, and are imperceptibly affected by the presence or absence of those features in the demand model at all.
 - The model is incapable of capturing any market segmentation such as that suggested in company documents for the prepaid brands, and is in fact in sharp contradiction with those documents.

II. Porting Data Provides Reliable Information on Switching Behavior and Diversion

Formal demand estimation (which explicitly estimates consumer preferences for a product as a function of that product’s characteristics, including price) can be used to directly measure customer diversion – and neither of the Applicants’ expert teams has successfully done this. (In the next section we discuss Cornerstone’s demand model, which attempts direct estimation of diversion ratios.) Due to data limitations, direct estimation of diversion may be impractical in the present matter.

As an alternative, indirect information on diversion ratios, which relies on indications of subscriber switching behaviors, is readily available. Wireless carriers are keenly interested in tracking which competitors they steal customers from, as well as who their customers go to when they leave, and employ two types of approaches and data sets that can be used to infer

diversion ratios from switching data: porting data and surveys of switching behavior.⁴ In this section, we discuss how the carriers rely upon porting data. In Section IV we address the available information from switching data surveys.

Porting data represents the subset of the population of all switches in which the subscriber ported their phone number. The Commission collects actual local number portability (“LNP”) information that reflects the universe of all wireless carrier ports. Accordingly, LNP porting data is a very accurate measurement of switching behavior of customers who port their numbers when they switch providers. Not all customers port their numbers, of course, but it is a valuable indicator of customer switching, as evidenced by the Applicants’ reliance in the normal course of business on porting data.⁵

Compass argues, based on recent interviews it has conducted with Sprint and T-Mobile executives and on certain of the Applicants’ internal documents, that porting data is inaccurate and irrelevant.⁶ It also argues that porting data should not be used for diversion inferences because it is a non-random and biased sample of all switches.⁷ Compass further asserts that porting data is inferior to Harris Mobile Insights Survey data because it systematically over-represents Sprint,⁸ and is otherwise biased because it understates diversion to MVNOs.⁹ We show below that this is not the case. The Applicants routinely and primarily use porting data to assess consumer responses to price changes and other marketing promotions. We also show that, if biased in any way, porting data *under-samples* Sprint, thereby providing conservative information about switching behavior compared to Harris switching information.

⁴ Switching data generally does not isolate the switching in response to isolated price changes from switching that occurs for other reasons.

⁵ See TMUS-FCC-02597890 **{{BEGIN HCI**

END HCI}}

⁶ IKK Diversion White Paper at pp. 5-6.

⁷ IKK Diversion White Paper at p 3.

⁸ IKK Declaration at ¶ 176.

⁹ IKK Diversion White Paper at p. 4-5.

A. The Applicants rely on porting data in making major decisions in the normal course of business

The relevance of porting data as an indicator of consumer behavior may best be illustrated by the importance that the Applicants place upon it in ordinary course of business analysis, planning and decisions.

- T-Mobile reviews porting data (that it procures from Comlink) to understand subscriber switching behavior. Internal documents describe this data as providing {{BEGIN HCI

END HCI}}; and an {{BEGIN HCI

END HCI}}.¹⁰ Company documents also indicate that porting data is particularly accurate with respect to {{BEGIN HCI

END HCI}}.¹¹

- T-Mobile's reliance on porting data extends to the top executive level, highlighted by {{BEGIN HCI

END HCI}}.¹²

- Sprint uses porting data to {{BEGIN HCI

END HCI}}.¹³

¹⁰ See TMUS-FCC-01909049 at TMUS-FCC-01909051.

¹¹ TMUS-FCC-01914010.

¹² TMUS-FCC-02376783.

¹³ SPR-DOJ-04362565 at SPR-DOJ-04362603.

- Like Sprint, T-Mobile tracks porting performance with pricing promotions for all carriers, including for both postpaid and prepaid products.¹⁴ For example, T-Mobile identifies specific promotion events, such as {{BEGIN HCI

END HCI}}.¹⁵ T-Mobile also tracks prepaid performance in the same manner. For example, it identifies {{BEGIN HCI

END HCI}}.¹⁶

B. Porting data provides conservative information of switching behavior relative to Harris switching information

Compass has argued that LNP porting data is at odds with “gross additions,” “gross deactivations” and survey-based “switch in” and “switch out” data, and therefore should not be used to calculate diversion ratios. However, examination of the measures cited by Compass tells the opposite story; porting data is more in line with these data than not.

Table 1 shows the three addition / switch-in data sets that Compass summarized in their initial report: percentage gross adds (as estimated by T-Mobile); percentage switch-ins (from the Harris survey data); and percentage port-ins (from the Commission’s LNP data).¹⁷

¹⁴ TMUS-FCC-01648593.

¹⁵ *Id.* at 8.

¹⁶ *Id.* at 23.

¹⁷ See IKK Declaration at p. 129, Table 27.

Table 1: Share Comparison between T-Mobile Gross Adds, Port-Ins, and Switch-Ins From Various Sources (Most Recent 12 Months of Data)
{{BEGIN NRUF/LNP HCI

END NRUF/LNP HCI}}

Sources: IKK Backup Materials; LNP data; KPMG StreamShare. See IKK Declaration at p. 129, Table 27.

Comparing gross adds and switch ins with the porting data, Compass concluded that the porting data must be over sampling customers who switch-in to Sprint because the port-ins to Sprint (about **{{BEGIN NRUF/LNP HCI** **END NRUF/LNP HCI}}**) are higher than Sprint’s estimated share of gross-adds and the share of switch-ins shown in the Harris data (both about **{{BEGIN HCI** **END HCI}}**). In other words, Compass reasoned that Sprint is winning too large a share of subscribers in the porting data, which would tend to overstate diversion to Sprint, all else equal. Compass sought to bolster its argument by also noting that the opposite was the case for AT&T and Verizon; that is, the shares of port-ins to AT&T and Verizon is lower than the estimated share of gross-adds and switch-ins.

Compass’ table of comparisons was not complete, however. The Applicants also use data concerning gross additions from KPMG StreamShare, as did Compass and Cornerstone when estimating subscriber shares in their earlier reports. We added the percentage of gross-adds as estimated from the KPMG StreamShare data to Table 1, which then tells a very different story. Compass would come to the opposite conclusion if it had included the KPMG StreamShare data in its analysis: that the porting data in fact presents a conservative estimate of overall switching behavior, and under-samples switches to Sprint and oversamples switches to AT&T. It would also find that the Harris data over-samples AT&T and under-samples Sprint.

Additionally, Compass did not consider using deactivation (or churn), switch-out, and port-out data in its comparative analysis, which can also be used as an indicator of sampling biases. We present these data in Table 2. The table shows that the difference between porting, Harris switching, and the share of deactivations are as large as any difference between either of them

and port-outs. The table indicates that the porting data and the Harris data under-sample Sprint churn (relative to KMPG deactivations) while oversampling (and overstating) AT&T churn. For T-Mobile, the porting data more closely approximates deactivations than is seen in the Harris data. And the Harris data oversamples Verizon switch-outs while the porting data under-samples Verizon's churn. Harris *understates* T-Mobile's share of churn (while porting data arguably do not), and porting data, if anything, oversamples AT&T's churn.¹⁸ Thus, consideration of these data would also have led Compass to conclude that porting data presents a conservative estimate of overall switching behavior.

Table 2: Share Comparison between Deactivations, Port-Outs, and Switch-Outs From Various Sources (Most Recent 12 Months of Data)
{{BEGIN NRUF/LNP HCI

END NRUF/LNP HCI}}

Sources: IKK Backup Materials for Table 27; LNP data; KMPG StreamShare. See IKK Declaration at p. 129, Table 27.

C. Compass has previously found porting data to be a useful indicator of switching, despite any limitations

Compass' concerns about the relevance of porting data are contradicted by Dr. Israel's position in the AT&T-Leap merger review. In a report submitted in that proceeding, Dr. Israel relied on AT&T and Leap port-out information to calculate diversion between the brands.¹⁹ When considering the merits of porting data, Dr. Israel explained that:²⁰

¹⁸ It bears acknowledging that Verizon churn does appear to be understated in the LNP data, suggesting a disproportionately larger share of Verizon subscribers do not port their numbers when they deactivate, relative to other carriers' subscribers.

¹⁹ See An Economic Analysis of Competitive Effects and Consumer Benefits from the Proposed Acquisition of Leap Wireless by AT&T by Mark A. Israel. *In the Matter of Applications of Cricket License Company, LLC, et al., Leap Wireless International, Inc., and AT&T Inc. for Consent To*

Continued on next page

“Although porting (or other switching) data are one useful indicator of the degree of substitution between providers, they are imperfect and need to be evaluated in the context of other qualitative evidence (such as contained in this Declaration) and other empirical work.”

Dr. Israel noted some limitations in the use of porting data for diversion analysis, which generally mirror those we have explained here, including:²¹

- “Porting data include only subscribers who keep their phone numbers when switching, meaning that the data capture only a subset of switchers.”
- “Porting data, like most other switching data, do not capture only those customers who switch due to changes in quality-adjusted prices (the relevant sample for antitrust analysis), but rather include people who switch for any reason.”

Nevertheless, Dr. Israel explained that “[d]espite these limitations, porting data provide a useful indicator of the degree of substitution between providers.”²²

III. Survey Information Further Indicates that the Applicants’ Brands are Close Substitutes

Mobile carriers closely follow data concerning churn and customer behavior, and rely upon input from their own customers as well as switching surveys conducted by third-party marketing research firms. We review data from surveys that are used the Applicants in their ordinary course of business in subsections A and B, below.

Continued from previous page

Transfer Control of Authorization, WT Docket No. 13-193, August 9, 2013 (henceforth “Israel AT&T/Leap Report”) at ¶ 26.

²⁰ Israel AT&T/Leap Report at ¶ 26.

²¹ *Ibid.*

²² Israel AT&T/Leap Report at ¶ 27.

A. Internal Documents of Switching Behavior Indicate High Switching Between the Applicants' Brands

Compass claims that the Applicants' internal documents indicate that there is low diversion between the Sprint and T-Mobile brands. We have reviewed the documents referenced in the Compass report as well as additional documents produced in this proceeding, and conclude that this is far from the case. The Applicants' internal documents show that they rely upon porting data as well as a wide range of surveys, including the Harris Mobile Insights Survey, their own internal surveys, and other surveys and industry intelligence. Review of these documents reveals that the Applicants recognize their brands to be closer substitutes for each other than either Compass or Cornerstone have suggested.

For example, Compass claims that **{{BEGIN HCI END HCI}}** of Boost customers who switch and port their numbers go to T-Mobile/MetroPCS, while **{{BEGIN HCI END HCI}}** of switching Boost customers who do not port their numbers also go to T-Mobile/MetroPCS.²³ However, these figures show that customers switch from Boost to the T-Mobile brands at a rate far in excess of the estimate found in the Cornerstone model. Moreover, information provided by Sprint can be used to estimate that approximately **{{BEGIN HCI END HCI}}** of Boost's gross additions ported their numbers.²⁴ Under the assumption that the porting incidence is similar for deactivations, the aggregate Boost-to-T-Mobile/MetroPCS switch rate would be **{{BEGIN HCI END HCI}}**.

Compass also overstates the conclusion that T-Mobile documents show "even lower switching rates between Sprint and T-Mobile than do the HarrisX data."²⁵ Considering that the referenced document only discusses MetroPCS deactivation surveys, the statement is approximately true with regard to the Harris data, although the differences are not stark. For comparison, the cited MetroPCS deactivations chart must be adjusted for only those subscribers who switch to a competing carrier, removing deactivations who drop wireless service.²⁶ As shown in Table 3,

²³ IKK Diversion White Paper at pp. 3-4, with calculations derived from SPR-FCC-02425213 at SPR-FCC-02425217 and SPR-FCC-04301172 at SPR-FCC-04301177.

²⁴ SPR-FCC-01090636, on average for 2016-2018.

²⁵ IKK Diversion White Paper at p. 6, citing TMUS-FCC-07675268.

²⁶ The Harris survey information is limited to subscribers who switched wireless service brands, and doesn't include those who do not keep wireless service.

below, after doing so, approximately {{BEGIN HCI END HCI}} of MetroPCS deactivations switching to another carrier chose Sprint and {{BEGIN HCI END HCI}} choose Boost.²⁷ The comparable Harris numbers are {{BEGIN HCI END HCI}}, respectively.

Table 3: MetroPCS Deactivations Survey
{{BEGIN HCI

END HCI}}

Sources & Notes: TMUS-FCC-07675268 at TMUS-FCC-07675282; TMUS-FCC-05216523 at TMUS-FCC-05216540. Subscribers that chose no service or T-Mobile removed from calculations. TMUS-FCC-07675268 figures used for Q4 2017.

T-Mobile itself has recognized that its MetroPCS deactivation survey yields contradictory information regarding switching to the Sprint brands (including Boost), and likely is understating switching to the Sprint brands. For example, after working to construct an apples-to-apples comparison of brand switching across {{BEGIN HCI

END HCI}}, T-Mobile employees circulated an internal email with the following switching shares for subscribers leaving MetroPCS:

²⁷ Based on the average for all of 2017.

**Figure 1: Internal Document Showing Share of Switch-Outs
by Carrier for Alternative Data Sources**
{{BEGIN HCI

END HCI}}

Source: TMUS-FCC-01906347.

The email then notes that {{BEGIN HCI
END HCI}} and that the deviation from
these two versus the deactivation survey may be explained because {{BEGIN HCI
END
HCI}}²⁸ In contrast to Compass’ claim that T-Mobile internal documents show low diversion
from MetroPCS to the Sprint Brands, it appears that T-Mobile believes that as much as {{BEGIN
HCI END HCI}} of subscribers leaving MetroPCS switch to a Sprint brand.

Mobile wireless carriers also attempt to track the reasons why subscribers switch service, asking whether the primary reason was due to, for example, plan pricing, phone pricing, network quality, phone choice, etc. These surveys provide insight concerning the brands that subscribers switch to when the primary reason for switching is pricing related—information that provides a proxy for diversion in response to price insofar as it isolates the switching reason from other reasons to switch, such as network quality. For example, in Table 4, below, we extract data reported about the survey regarding the respondents who switched due to plan or phone cost reasons.

²⁸ TMUS-FCC-01906347.

Table 4: Boost Primary Reason for Switching to Current Carrier
{{BEGIN HCI

END HCI}}

Sources & Notes: SPR-FCC-02425213 at SPR-FCC-02425220. Sprint subscribers omitted from the analysis.

[1]: Number of Respondents that previously had Boost and are now with a different carrier.

[2]: Percent of respondents that stated plan cost as the reason for switching away from Boost.

[3]: [1]x[2].

[4]: [3]/Sum of [3] across all brands.

[5]: Percent of respondents that stated phone cost as the reason for switching away from Boost.

[6]: [1]x[5].

[7]: [6]/Sum of [6] across all brands.

[8]: [2]+[6]

[9]: [8]/Sum of [8] across all brands.

As the table shows, we calculate that {{BEGIN HCI END HCI}} port outs identify plan price as the number one reason for Boost churn. Of these, {{BEGIN HCI END HCI}} chose MetroPCS while just {{BEGIN HCI END HCI}} chose AT&T or Verizon postpaid combined. We also calculate that {{BEGIN HCI END HCI}} port outs identify phone price as the number one reason for Boost churn. Of these, {{BEGIN HCI END HCI}} chose MetroPCS while just {{BEGIN HCI END HCI}} chose AT&T or Verizon postpaid combined. Finally, {{BEGIN HCI END HCI}} port outs identify either plan or phone price as the number one reason for leaving Boost, and of these {{BEGIN HCI END HCI}} chose MetroPCS, while {{BEGIN HCI END HCI}} chose AT&T or Verizon postpaid combined. Needless to say, as a possible indicator of diversion between Boost and MetroPCS, these switching shares are substantially higher, at {{BEGIN HCI END HCI}}, than any evidence on diversion that has been suggested by Compass or Cornerstone.

T-Mobile also conducts surveys that ask departing subscribers about their reasons for leaving. In Table 5, below, we extract data reported in a MetroPCS deactivations survey regarding the respondents who switched due to plan or phone cost reasons.

Table 5: Metro PCS Primary Reason for Switching to Current Carrier
{{BEGIN HCI

END HCI}}

Sources & Notes: TMUS-FCC-07675268 at TMUS-FCC-07675290. T-Mobile subscribers removed from the analysis.

[1]: Number of Respondents that previously had MetroPCS and are now with a different carrier.

[2]: Percent of respondents that stated plan cost as the reason for switching away from MetroPCS.

[3]: [1]x[2].

[4]: [3]/Sum of [3] across all brands.

[5]: Percent of respondents that stated phone upgrade process/cost as the reason for switching away from MetroPCS.

[6]: [1]x[5].

[7]: [6]/Sum of [6] across all brands.

[8]: [2]+[6]

[9]: [8]/Sum of [8] across all brands.

As shown in the table, **{{BEGIN HCI END HCI}}** of subscribers leaving MetroPCS because of plan cost go to either Sprint or Boost, and **{{BEGIN HCI END HCI}}** of those leaving because of phone upgrade process/cost go to either Sprint or Boost. Of the respondents who indicated either plan costs or phone cost reasons for leaving, **{{BEGIN HCI END HCI}}** switched to either Sprint or Boost. Again, as a possible indicator of diversion from MetroPCS to the Sprint brands, these switching shares are substantially higher, at **{{BEGIN HCI END HCI}}**, than any evidence on diversion that has been suggested by Compass or Cornerstone.

B. Harris Survey Information Indicates Greater Switching Among the Applicants' Brands for Relevant Subscribers than as Reported by IKK

Compass cited summaries from the Harris Mobile Insights survey, explaining that approximately {{BEGIN HCI END HCI}} of Sprint's churning subscribers switch into or from T-Mobile, and that approximately {{BEGIN HCI END HCI}} of T-Mobile's churning subscribers switch into or from Sprint.²⁹ These figures are calculated at the national level as reported by Harris, and are aggregated across the carriers' different brands (e.g., T-Mobile postpaid, T-Mobile prepaid, and MetroPCS).

Harris also examines switching behavior across geographies based on population density, coding into four categories: urban, suburban core, suburban fringe, and small town/rural. The carriers also assess performance across density types. For example, T-Mobile internal documents note that {{BEGIN HCI END HCI}} as shown in the figure below.

²⁹ IKK Declaration at pp. 123-131. See IKK Declaration at p. 131, Table 28.

Figure 2: T-Mobile Chart on Churn Capture by Geography Type
{{BEGIN HCI

END HCI}}

Source: TMUS-FCC-06791239 at TMUS-FCC-06791246, based on Harris Mobile Insights for Q2 2018, blended prepaid and postpaid.

{{BEGIN HCI

END HCI}} For example, T-Mobile documents explain that:

- {{BEGIN HCI
are “small town/rural;”³⁰ END HCI}}
- {{BEGIN HCI
END HCI}};”³¹
- “{{BEGIN HCI
END HCI}}.”³²

³⁰ TMUS-FCC-05216523 at TMUS-FCC-05216572.

³¹ TMUS-FCC-01921555.

³² TMUS-FCC-01921565.

Additionally, we have examined subscriber location data provided by Sprint, finding that just {{BEGIN HCI END HCI}} of Sprint postpaid subscribers, {{BEGIN HCI END HCI}} of Boost subscribers, and {{BEGIN HCI END HCI}} of Virgin subscribers are located in rural counties.³³ This may be not altogether surprising when we consider that Sprint’s wireless infrastructure is focused more on urban areas than on rural ones.³⁴

These differences in subscriber bases also show up in the competition for gross adds. Table 6, below, presents the share of switch-ins by carrier (for all of the carrier’s brands) and by population density region, as seen in the Harris data.

Table 6: Carrier Share of Harris Switch-Ins, by Regions
{{BEGIN HCI

END HCI}}

Source: Harris Mobile Insights Survey, May 2017 - April 2018.
Note: Percentages calculated within region. Other includes Consumer Cellular, US Cellular, TracFone and "Other" as designated in the raw data.

As shown in the table, while T-Mobile succeeded in capturing {{BEGIN HCI END HCI}} of switches across the entire sample of Harris survey respondents, it captures {{BEGIN HCI END HCI}} switches in densely populated urban and suburban areas and {{BEGIN HCI END HCI}} switches in rural areas. Specifically, T-Mobile

³³ Based on Brattle calculations on Cornerstone backup materials of Sprint subscribers by geographic region, “DOJ Specification 27 - Prepaid.xlsx” and “DOJ Specification 27 - Postpaid.xlsx”, combined with census urban/rural classifications for counties.

³⁴ See Declaration of Joseph Harrington, Coleman Bazelon, Jeremy Verlinda, and William Zarakas, Exhibit B to Petition to Deny of DISH Network Corporation, *In the Matter of Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations*, WT Docket No. 18-197, August 27, 2018 at pp. 103-104, Figures 7-10, showing spectrum holdings by carrier.

HCI END HCI}} of AT&T switch-ins and {{BEGIN HCI END HCI}} of Verizon switch-ins are in non-rural areas.

The Harris survey allows for calculation of switching ratios by region type. To the extent that these can be used as estimates of diversion ratios, they are presented in Table 8, below.

Table 8: Diversion Ratios by Region Type in Harris Data
{{BEGIN HCI

END HCI}}

Sources and Notes:

[1]: IKK Declaration at p. 131, Table 28.

[2] - [6]: IKK Backup Materials. Harris Mobile Insights.

As shown in the table, whereas the national-level calculations from the Harris survey result in diversion estimates of {{BEGIN HCI END HCI}} for Sprint to T-Mobile and of {{BEGIN HCI END HCI}} for T-Mobile to Sprint, the numbers associated with non-rural regions are considerably higher. For example, the diversion estimate from Sprint to T-Mobile ranges from just {{BEGIN HCI END HCI}} in rural areas to approximately {{BEGIN HCI END HCI}} in urban areas. Likewise, the diversion estimate from T-Mobile to Sprint ranges from {{BEGIN HCI END HCI}} in rural areas to {{BEGIN HCI END HCI}} in urban areas. Across the non-rural areas, the diversion estimate from Sprint to T-Mobile would be {{BEGIN HCI END HCI}}, and from T-Mobile to Sprint it would be {{BEGIN HCI END HCI}}.

These {{BEGIN HCI

END HCI}} imply greater scope for merger-related price increases than would be suggested by the aggregate, national-level Harris survey results alone. In the more densely populated areas of competitive focus for the Applicants, even

the Harris information shows they are far closer substitutes than the aggregate, national-level summaries would suggest.

IV. The Cornerstone Model Provides no Updated Information Regarding Diversion Ratios in Response to Changes in Prices or Quality

In its November report, Cornerstone claimed to have developed a demand model that would provide diversion ratios that were more in line with substitution effects (driven by changes in a provider's prices or quality) than other sources, specifically porting data, customer switching surveys and/or market shares. Additionally, in its December filing,³⁵ Cornerstone further claimed that (a) its model "estimates the diversion ratios that are actually relevant to assessing the competitive effects of the proposed merger",³⁶ (b) estimates of diversion from switching information are obviated by the diversion estimates from the Cornerstone demand model,³⁷ and (c) in any event, porting data is not representative of all switching behavior.³⁸

Compass has also amended its position concerning the estimation of diversion ratios,³⁹ asserting that Cornerstone "directly calculates true diversion ratios" that are "far superior" to any estimates from switching data (including porting).⁴⁰

As we explained above, diversion can be measured either directly or indirectly. Direct measures of diversion include formal demand estimation that explicitly estimates consumer preferences for a product as a function of that product's characteristics, including price. Diversion can also be

³⁵ Response to Dish and CWA Comments by John Asker, Timothy F. Bresnahan, and Kostis Hatzitaskos. *In the Matter of Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations*, WT Docket No. 18-197, December 18, 2018 (henceforth "Cornerstone Response").

³⁶ Cornerstone Response at ¶ 12.

³⁷ Cornerstone Response at ¶ 13.

³⁸ Cornerstone Response at ¶ 16.

³⁹ IKK Diversion White Paper.

⁴⁰ IKK Diversion White Paper at pp. 1-2.

formally estimated when high-frequency information on product-level prices and quantity sales is available.⁴¹ Such information, required for accurate and precise *direct* estimation of diversion, is often unavailable, including in the present matter. Cornerstone and Compass claim that Cornerstone’s attempt to estimate wireless services demand from NMP data provides a “superior” direct estimate of diversion. As we explain below, the Cornerstone model is incapable of measuring meaningful diversion ratios, and, in any case, the data used by Cornerstone is insufficient for the task.⁴²

Careful examination of the Cornerstone demand model reveals that, contrary to claims by Compass and Cornerstone that the Cornerstone demand model calculates “true diversion ratios based on own- and cross-elasticities” that are “far superior estimates of diversion ratios than are switching rates,”⁴³ the truth is anything but. The Cornerstone demand model’s diversion ratio estimates are instead merely assumed values that effectively reproduce diversion in proportion to share. Furthermore, Cornerstone buries this opaque result in a model where price and network quality have no direct effect on the diversion estimates. A technical explanation of these flaws is provided in subsection A below.

Moreover, Compass and Cornerstone err in concluding that the *estimated* diversion from the Cornerstone demand model supports share-proportionality as an approximation for diversion, since the model does not “find” approximate share proportionality, but instead just assumes it. Rather, as we explain,⁴⁴ share-proportionality is itself sharply contradicted by information contained in the Applicants’ ordinary course of business documents. As shown in those documents, the Applicants’ products are close substitutes, with diversion among their brands that is far greater than arises under the assumption of share-proportionality. Cornerstone’s model and resulting diversion ratios therefore should not be relied upon as evidence of the closeness of substitutes of the Applicants’ products, nor in any merger simulation analysis.

⁴¹ By “high frequency”, we mean that the data ideally should span many time periods and many geographic markets.

⁴² In particular, although the NMP data spans multiple geographic areas, because it contains no information on subscribers making multiple wireless brand choices over time, it is effectively just a cross-section of brand choices.

⁴³ IKK Diversion White Paper at pp. 1-2.

⁴⁴ Further discussion of internal documents and surveys as they pertain to diversion is provided in Section III as well.

A. Cornerstone's demand model is built on an underlying assumption of share-proportional diversion

In this subsection and accompanying Appendix, we explore the mathematical foundations for diversion calculations in the Cornerstone demand model to show how its reproduction of share-proportional diversion is pre-determined by the model's underlying assumptions about consumer demand. We explain the implications of the derived diversion formula, and also show how the existence of network quality and subscriber demographic information in the demand model does little to affect the calculated diversion ratios.

Cornerstone estimates a logit demand model with the following utility specification for subscriber i of data-use type t , located in geographic region l , choosing brand j :

$$U_{ij} = \alpha_{lj} + \alpha_{tj} + \beta_t x_{ij} + \gamma_j C_i + \varepsilon_{ij} = V_{ij} + \varepsilon_{ij}$$

where x_{ij} includes brand characteristics such as network quality (e.g., speed) and C_i includes subscriber-level demographics (e.g., income).⁴⁵ Prices are unobserved in the Cornerstone demand model, but could hypothetically be captured as one of the brand characteristics in x_{ij} .⁴⁶ The error term ε_{ij} is defined such that the probability that subscriber i chooses brand j is:

$$P_{ij} = \frac{\exp(V_{ij})}{\sum_{k'} \exp(V_{ik'})},$$

which is the familiar logit formula. It follows that the share of brand j is

$$s_j = \sum_i \omega_i P_{ij},$$

where ω_i denotes the sampling weight for subscriber i .⁴⁷ As shown in the Appendix, the diversion ratio representing the fraction of brand j lost sales that divert to brand k , in response to an increase in price (or reduction in quality) of brand j , is calculated as

⁴⁵ Cornerstone includes fixed effects at the brand-location and brand-subscriber data type levels (the α_{lj} and α_{tj} parameters in the utility specification).

⁴⁶ See footnote 54 for further discussion of how Cornerstone and Brattle treat prices in this model.

⁴⁷ Cornerstone explains that they reweight the sample of NMP data such that brand shares and subscriber counts within a geographic region match the KPMG ShareStream data.

$$D_{jk} = \frac{\sum_i \omega_i P_{ik} P_{ij}}{\sum_i \omega_i P_{ij} (1 - P_{ij})}.$$

This equation is notable in the following ways:

1. It does not depend on the model estimates for the effects of brand characteristics on utility. For example, while price sensitivity is only indirectly determined by Cornerstone (through a supply side assumption, not through the demand model), that estimated price sensitivity has no effect on the estimated diversion ratios.
2. It does not depend on the change in the characteristic underlying the reason subscribers change brands (be it price, speed, coverage, or any other feature that could be modeled).⁴⁸
3. A natural consequence of 1 and 2 above is that the same diversion values are calculated for a change in price as for a change in any other brand characteristic.
4. If the choice probabilities are equal across individuals ($P_{ij} = P_j$ for all i), as they are for the antitrust logit model, the diversion ratio collapses to the familiar share proportionality formula, $s_k / (1 - s_j)$.
5. It depends on the estimated parameters of the utility model only insofar as individual choice probabilities are calculated from the model. Provided there are alternative-specific constants (as there are in the Cornerstone specification), regardless of the product characteristics or demographics modeled, the (weighted) average choice probabilities will exactly reproduce the brand shares in each geographic region.

In the general case, with unequal weights and choice probabilities, because the individual choice probabilities still add up to observed shares, we would still expect diversion under the Cornerstone model specification to be approximately close to share proportionality. To see this more clearly, we consider the baseline alternative case where there are no network quality or subscriber demographics, equivalent to the “fixed effects only” version of the Cornerstone model. In this scenario, there is no variation across subscriber choice probabilities within a geographic region, such that,⁴⁹

$$P_{ij} = s_{lj} = \frac{\omega_{lj}}{\sum_{k'} \omega_{lk'}}.$$

⁴⁸ While the choice probabilities in the diversion equation depend on specific values for characteristics, these are all evaluated at the values observed in the survey data. The diversion formula does not depend on the *change* in any characteristic’s values.

⁴⁹ The individual subscriber weights in the Cornerstone model are equal across subscribers for a given brand in a specific geographic region, and are employed by Cornerstone to align the NMP data with regional and national shares.

In other words, the individual choice probabilities in the “fixed effects only” model are just equal to local shares. Consequently, the calculation of the national diversion ratios in Cornerstone’s “fixed effects only” model variant is an aggregation of local shares:⁵⁰

$$D_{jk} = \frac{\sum_l \omega_l s_{lk} s_{lj}}{\sum_l \omega_l (1 - s_{lj}) s_{lj}}.$$

This “fixed effects only” diversion ratio modifies the usual formula for share-proportional diversion based on national shares by allowing for different weights across geographies based on the number of subscribers in each geography. It is, effectively, an alternative calculation for determining diversion as proportional to shares.

A table of the resulting diversion ratios is provided in the Appendix.⁵¹ Figure 3, below, provides a comparison of the diversion estimates from the full Cornerstone model to diversion that is proportional to share, as calculated under Cornerstone’s “fixed effects only” model.

⁵⁰ See Appendix for derivation.

⁵¹ The Appendix also includes complete diversion tables based on national shares and based on the full Cornerstone model.

Figure 3: Cornerstone Diversion Estimates versus Share Proportionality
Cornerstone Fixed Effects Model
(Aggregating Local Shares from KPMG StreamShare data)
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Source: Brattle calculations, Cornerstone Report Exhibits 12, 81, and Cornerstone Report Backup Materials

As shown in the figure, when diversion calculated as proportional to share is lower, diversion in the full Cornerstone model is also lower, and when share-proportional diversion is higher, diversion in the full Cornerstone model is also higher. In fact, the values nearly follow a one-for-one mapping between the two (as shown by the 45-degree line on the chart), and the average difference between share-proportional and the full Cornerstone diversion values is just **{{BEGIN HCI**
HCI **END HCI}}**, and never greater than **{{BEGIN HCI**
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B. The Cornerstone demand model is incapable of capturing market segmentation that would allow for subsets of products to be closer substitutes than their aggregate wireless shares

The Cornerstone demand model's diversion estimates cannot support a conclusion that share-proportional diversion is an approximation of wireless subscriber preferences. Instead, evidence on switching rates indicates that share-proportional diversion is a poor approximation of the closeness to which the Applicants' brands are direct substitutes, and that a model that is built on an underlying assumption of share-proportional diversion, such as the Cornerstone model, is inappropriate for estimating wireless subscriber demand.

Share-proportional diversion is an inappropriate foundation for wireless demand estimation because it is incapable of reflecting meaningful segmentation within a market, especially for brands with smaller market shares, such as Boost and MetroPCS. By definition, under a share-proportional model, providers with small subscriber shares will have relatively low diversion ratios, and providers with large subscriber shares will have high diversion ratios, irrespective of the actual degrees of substitutability. As a consequence of the assumed form of demand and the data employed, the Cornerstone model is incapable of finding meaningful market segmentation and will only approximate share-proportional diversion.

Examination of the diversion ratio that the Cornerstone model calculated for a smaller brand provider (Boost) bears this out. Sprint's internal analysis developed during the ordinary course of business indicates that **{{BEGIN HCI END HCI}}** of subscribers porting out of Boost switch to MetroPCS (with just **{{BEGIN HCI END HCI}}** switching to either AT&T or Verizon postpaid products, combined).⁵² Harris data indicated a similar direction, with more than **{{BEGIN HCI END HCI}}** of subscribers leaving Boost switching to MetroPCS (and just

⁵² See SPR-FCC-024252113 at SPR-FCC-02452117. Also, see IKK Diversion White Paper at pp. 3-4, describing that more than **{{BEGIN HCI END HCI}}** of Boost subscribers switch to either T-Mobile or MetroPCS, whereas Cornerstone estimates the combined diversion to be **{{BEGIN HCI END HCI}}**, and share-proportional diversion would be **{{BEGIN HCI END HCI}}**. Most of Cornerstone's **{{BEGIN HCI END HCI}}** diversion to T-Mobile brands is T-Mobile itself, not because it is estimated to be a closer substitute to Boost than is MetroPCS, but because T-Mobile has greater market share than MetroPCS. In contrast, **{{BEGIN HCI END HCI}}** of Boost port-outs are to MetroPCS and **{{BEGIN HCI END HCI}}** are to T-Mobile (SPR-FCC-02452117).

{{BEGIN HCI END HCI}} switching to either AT&T or Verizon postpaid products, combined).⁵³ Yet these estimates are significantly greater than the results from the Cornerstone model, which calculated the Boost-to-MetroPCS diversion ratio as just {{BEGIN HCI END HCI}} (and over {{BEGIN HCI END HCI}} switching to either AT&T or Verizon postpaid products, combined).

Consider the ratios of these values. Of Boost ports out, switchers are {{BEGIN HCI END HCI}} likely to choose MetroPCS than AT&T or Verizon postpaid combined. In the Harris data, subscribers leaving Boost are almost {{BEGIN HCI END HCI}} as likely to choose MetroPCS than AT&T or Verizon postpaid combined. The Cornerstone diversion estimates present a reversal of these switching patterns, with more than {{BEGIN HCI END HCI}} times as many Boost subscribers diverting to AT&T or Verizon postpaid combined as diverting to MetroPCS—driven entirely by the fact that AT&T and Verizon have the largest shares and not because Cornerstone has estimated that AT&T or Verizon are the next best substitutes for Boost subscribers.

The diversion ratios calculated under Cornerstone’s model are thus self-fulfilling. Low shares beget low diversion ratios. Brand characteristics and subscriber demographics do not result in any meaningful adjustments to the choice probabilities or subscriber preferences in the Cornerstone model, and have no material effect on the calculated diversion ratios.

⁵³ For the Harris “national” summary, {{BEGIN HCI END HCI}} of subscribers leaving Boost switch to MetroPCS. Among urban subscribers, more than {{BEGIN HCI END HCI}} of subscribers leaving Boost switched to MetroPCS. *See* IKK Declaration Backup Materials.

Appendix

A. Derivation of Cornerstone Diversion Ratios

As explained above, Cornerstone estimates a logit demand model with the following utility specification for subscriber i of data-use type t , located in geographic region l , choosing brand j :

$$U_{ij} = \alpha_{lj} + \alpha_{tj} + \beta_t x_{ij} + \gamma_j C_i + \varepsilon_{ij} = V_{ij} + \varepsilon_{ij}$$

where x_{ij} includes brand characteristics such as network quality and C_i includes subscriber-level demographics. Prices are unobserved in the Cornerstone demand model, but could hypothetically be captured as one of the brand characteristics in x_{ij} .⁵⁴ The error term ε_{ij} is defined such that the probability that subscriber i chooses brand j is:⁵⁵

$$P_{ij} = \frac{\exp(V_{ij})}{\sum_{k'} \exp(V_{ik'})}$$

which is the familiar logit formula. It follows that the share of brand j is

$$s_j = \sum_i \omega_i P_{ij}$$

where ω_i denotes the sampling weight for subscriber i .

For this model, *diversion* is defined as the unit sales recaptured by brand k of the sales lost by brand j in response to a change in a characteristic of brand j (e.g., price or quality). That is,

⁵⁴ Cornerstone considers a decomposition of the location-brand fixed effect into a separate location-brand fixed effect and a brand-varying price (that does not vary by individual or location). In *BVZ Further Reply Declaration*, we also considered a decomposition of the brand coefficient on income into a separate brand coefficient and a brand-varying price (also not varying by individual or location). Neither of these decompositions formally models consumer demand as a function of price, nor do they capture any plan-specific pricing features or the potential for individual subscribers to face carrier promotions that could vary by plan, brand, location or individual. The diversion calculations here are ultimately not functionally affected by how the (un-modeled) prices enter the utility specification, provided they do so linearly. See Further Reply Declaration of Coleman Bazelon, Jeremy Verlinda, William Zarakas, *In the Matter of Applications of T-Mobile US, Inc. and Sprint Corporation for Consent to Transfer Control of Licenses and Authorizations*, WT Docket No. 18-197, December 4, 2018.

⁵⁵ Specifically, the error term is distributed as a Type 1 extreme value random variable.

$$D_{jk} = \frac{-\frac{\partial s_k}{\partial x_{lj}}}{\frac{\partial s_j}{\partial x_{lj}}},$$

In order to calculate the share derivatives for diversion, we must calculate the derivative of the individual choice probabilities with respect to the changing brand feature:

$$\frac{\partial s_k}{\partial x_{lj}} = \sum_i \omega_i \frac{\partial P_{ik}}{\partial x_{lj}}.$$

Under the multinomial logit, these derivatives are

$$\frac{\partial P_{ik}}{\partial x_{lj}} = -\beta_l P_{ik} P_{ij},$$

and

$$\frac{\partial P_{ij}}{\partial x_{lj}} = \beta_l P_{ij} (1 - P_{ij}).$$

It follows then that diversion for the multinomial logit is

$$\begin{aligned} D_{jk} &= \frac{-\sum_i \omega_i \frac{\partial P_{ik}}{\partial x_{lj}}}{\sum_i \omega_i \frac{\partial P_{ij}}{\partial x_{lj}}} \\ &= \frac{-\sum_i -\omega_i \beta_l P_{ik} P_{ij}}{\sum_i \omega_i \beta_l P_{ij} (1 - P_{ij})} \\ &= \frac{\sum_i \omega_i P_{ik} P_{ij}}{\sum_i \omega_i P_{ij} (1 - P_{ij})}. \end{aligned}$$

We have also considered calculation of the diversion ratios under Cornerstone’s “fixed effects only” variant of the model, where

$$U_{ij} = \alpha_{ij} + \varepsilon_{ij} = V_j + \varepsilon_{ij}.$$

In this model, choice probabilities for each brand are equal for all subscribers in a given geographic region, such that

$$P_{ij} = s_{lj} = \frac{\omega_{lj}}{\sum_{k'} \omega_{lk'}},$$

where ω_{lj} is the weight assigned by Cornerstone to an individual subscriber choosing brand j in region l . It follows that the resulting national diversion ratio from this model variant is

$$\begin{aligned} D_{jk} &= \frac{\sum_l \sum_{i \in \mathcal{N}_l} \omega_i P_{ik} P_{ij}}{\sum_l \sum_{i \in \mathcal{N}_l} \omega_i (1 - P_{ij}) P_{ij}} \\ &= \frac{\sum_l \sum_{i \in \mathcal{N}_l} \omega_i s_{lk} s_{lj}}{\sum_l \sum_{i \in \mathcal{N}_l} \omega_i (1 - s_{lj}) s_{lj}} \\ &= \frac{\sum_l s_{lk} s_{lj} \sum_{i \in \mathcal{N}_l} \omega_i}{\sum_l (1 - s_{lj}) s_{lj} \sum_{i \in \mathcal{N}_l} \omega_i}. \end{aligned}$$

Since $\omega_i = \omega_{lj}$ for each of the combined N_{lj} subscribers in geographic region l that choose brand j , the final summations in the diversion equation become

$$\sum_{i \in \mathcal{N}_l} \omega_i = \sum_{m'} N_{lm'} \omega_{lm'} = \omega_l.$$

Therefore, the final “fixed-effects only” national diversion ratio is

$$D_{jk} = \frac{\sum_l \omega_l s_{lk} s_{lj}}{\sum_l \omega_l (1 - s_{lj}) s_{lj}},$$

which is seen to be a function of only the local weights for NMP respondents that ensure alignment with local and national shares.

B. Diversion Estimates from Cornerstone Data and Model

Cornerstone’s actual calculation of the diversion ratios shown in Exhibit 12 of their report do not use the diversion formula above. Instead, Cornerstone approximates the diversion ratio by implementing a small increase in price and calculating the implied changes in shares. We have applied the diversion formula as specified above and are able to precisely replicate the diversion ratio values shown in Exhibit 12 of the Cornerstone report. Below, we present the full sets of diversion ratios across the products in Cornerstone’s NMP data.

**Table 9: Diversion Proportional to Share
(National Shares)
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Source: Brattle calculations and Cornerstone Report Exhibit 81.

**Table 10: Diversion Proportional to Share / Cornerstone Fixed Effects Model
(Aggregating Local Shares from KPMG StreamShare data)
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Source: Brattle calculations and Cornerstone Report Backup Materials.

Table 11: Diversion Estimated by Cornerstone Model
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Source: Cornerstone Report Exhibit 12.

C. Diversion Estimates from Porting Data

Table 12: Summary of Porting Behavior by Brand
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Source: Brattle Calculations based on TMUS-FCC-00206649 (Comlink) for Dec 2017.

Notes: Ports by carrier represent average of ports in and ports out.

Table 13: Summary of Porting Behavior by Carrier
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Source: Brattle Calculations based on TMUS-FCC-00206649 (Comlink) for Dec 2017.

Notes: Ports by carrier represent average of ports in and ports out.

D. Diversion Estimates from Harris Survey Data

Table 14: Harris Summary of Porting Behavior by Brand

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Source: Harris Mobile Insights Survey, January - April 2018.

Table 15: Harris Summary of Porting Behavior by Carrier⁵⁶

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END HCI}}

Source: Harris Mobile Insights Survey, January - April 2018.

⁵⁶ Values deviate from IKK Declaration Table 28 because “Other” carriers are not allocated in this table as they are in the Compass table. For example, pre-allocation, the switching ratio from Sprint to T-Mobile is 35.9%, whereas post-allocation the switching ratio is 37.4%.